

```

> library(DoE.base)
> nozzle <- fac.design(nfactors= 2,replications= 54,repeat.only=FALSE,randomize= F,seed=
24024 ,nlevels=c(3,3),factor.names=list(A=c(7.2,14.7,22.2),B=c(8,10,12)))
> milkflavour<-c(7,5,5,5,3,3,7,3,3,4,5,4,5,7,6,8,5,5,5,7,5,7,2,2,5,2,5,9,7,6,7,4,8,4,5,6,5,7,5,7,8,9,7,
4,2,8,8,5,6,6,6,8,6,7,5,8,7,7,6,6,3,3,6,6,7,7,5,6,7,7,7,6,7,7,7,7,7,6,7,7,9,8,7,8,8,8,8,9,8,9,8,8,7,
8,7,8,8,8,7,8,6,9,7,7,6,5,5,5,7,6,5,6,4,6,7,8,7,8,6,7,7,7,6,7,8,8,8,8,8,8,7,8,8,7,7,7,5,5,6,7,8,8,7,
8,8,8,8,8,6,8,6,5,7,4,6,4,3,6,8,7,8,7,8,7,7,6,6,7,6,7,8,8,8,7,7,7,7,8,8,7,7,7,7,6,6,6,6,6,7,7,9,
8,8,7,6,7,7,7,8,8,6,2,9,4,4,6,4,3,7,6,7,7,4,8,8,5,7,8,6,7,6,7,7,6,8,4,9,9,9,9,7,8,7,7,8,7,6,6,7,7,6,6,6,
6,8,9,8,9,8,8,8,8,4,7,3,9,9,8,9,9,7,7,6,6,6,6,6,7,7,7,4,6,6,6,4,4,6,4,6,5,6,6,8,8,6,7,7,6,9,8,8,8,9,9,
9,9,8,6,6,7,7,7,6,7,7,6,4,6,5,7,6,6,7,8,8,2,6,7,8,7,5,6,7,1,4,8,7,6,8,8,6,3,6,6,6,8,8,3,7,3,4,5,6,5,7,6,
4,6,5,6,5,5,8,6,7,6,7,6,5,5,4,3,7,6,4,4,3,6,3,3,6,5,4,5,6,6,6,6,8,7,4,8,6,7,5,7,4,4,4,4,3,4,4,4,4,3,3,3,
2,7,8,6,4,6,2,8,8,8,8,9,9,9,8,8,8,7,6,8,7,5,7,6,6,7,8,7,6,6,5,8,7,5,5,6,4,5,4,4,5,5,4,6,6,5,7,8,6,8,7,5,
5,8,8,8,6,7,7,7,7,8,7,8,7,8,7,7,8,8,3,4,4,6,5,4,4,3,2)
> nozzle$milkflavour<-milkflavour
> nozzle.aov<-aov(milkflavour~A*B,data=nozzle)
> summary(nozzle.aov)

```

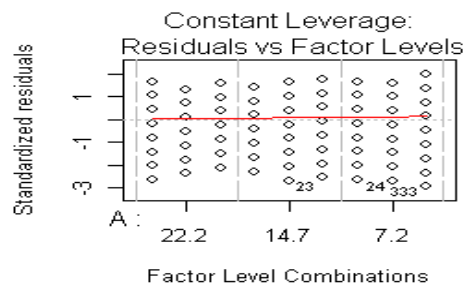
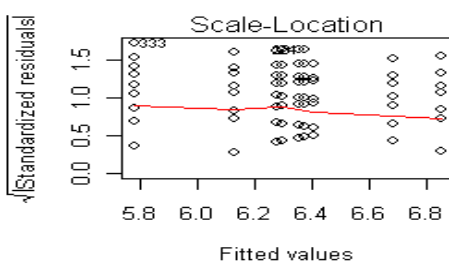
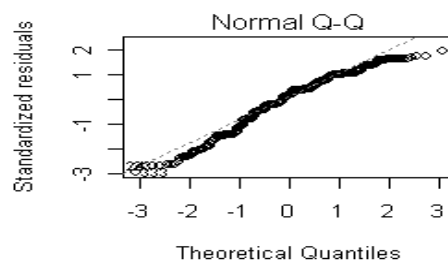
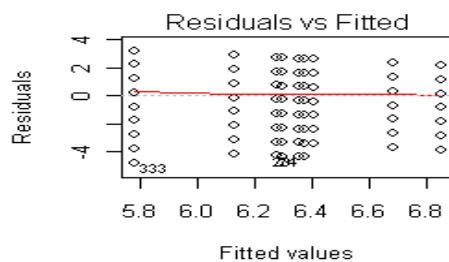
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	11.86	5.9280	2.2231	0.10939
B	2	15.46	7.7305	2.8991	0.05604
A:B	4	13.29	3.3230	1.2462	0.29046
Residuals	477	1271.93	2.6665		

```

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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> oldpar<-par(oma=c(0,0,3,0),mfrow=c(2,2))
> plot(nozzle.aov)
> par(oldpar)

```

aov.default(milkflavour ~ A * B)



```

> percentcows<- rep(c(rep(c(7.2),times=3),rep(c(14.7),times=3),rep(c(22.2),times=3)),times=54)
> percentkiwi<- rep(c(rep(c(8),times=1),rep(c(10),times=1),rep(c(12),times=1)),times=162)
> nozzle.rsm <- data.frame(percentcows,percentkiwi,milkflavour)
> nozzle.rsm

> library(rsm)
> nozzle.CR <- coded.data(nozzle.rsm,x1~(percentcows-14.7)/7.5,x2~(percentkiwi-10)/2)
> nozzle.rs<- rsm(milkflavour ~ SO(x1,x2), data=nozzle.CR)
> summary (nozzle.rs)

```

Call:

```
rsm(formula = milkflavour ~ SO(x1, x2), data = nozzle.CR)
```

Residuals:

	Min	1Q	Median	3Q	Max
	-4.7443	-0.7443	0.3066	1.3066	3.2557

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	6.56379	0.16565	39.625	<2e-16 ***
x1	-0.15741	0.09073	-1.735	0.0834 .
x2	-0.18827	0.09073	-2.075	0.0385 *
x1:x2	-0.15278	0.11112	-1.375	0.1698
x1^2	-0.26235	0.15715	-1.669	0.0957 .
x2^2	-0.05864	0.15715	-0.373	0.7092

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.633 on 480 degrees of freedom

Multiple R-squared: 0.02465, Adjusted R-squared: 0.01449

F-statistic: 2.427 on 5 and 480 DF, p-value: 0.03452

Analysis of Variance Table

Response: milkflavour

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
FO(x1, x2)	2	19.51	9.7562	3.6581	0.02650
TWI(x1, x2)	1	5.04	5.0417	1.8904	0.16980
PQ(x1, x2)	2	7.80	3.9023	1.4631	0.23254
Residuals	480	1280.18	2.6670		
Lack of fit	3	8.25	2.7502	1.0314	0.37835
Pure error	477	1271.93	2.6665		

Stationary point of response surface:

x1	x2
0.2697176	-1.9566058

Stationary point in original units:

percentcows	percentkiwi
16.722882	6.086788

Eigenanalysis:

\$values

[1] -0.03317901 -0.28780864

\$vectors

	[,1]	[,2]
[1,]	0.3162278	-0.9486833
[2,]	-0.9486833	-0.3162278

```
> nozzle.rs<- rsm(milkflavour ~ FO(x1,x2)+TWI(x1,x2), data=nozzle.CR)
> summary (nozzle.rs)
```

Call:

rsm(formula = milkflavour ~ FO(x1, x2) + TWI(x1, x2), data = nozzle.CR)

Residuals:

Min	1Q	Median	3Q	Max
-4.8513	-0.8513	0.4619	1.4573	3.1487

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	6.34979	0.07415	85.634	<2e-16 ***
x1	-0.15741	0.09082	-1.733	0.0837 .
x2	-0.18827	0.09082	-2.073	0.0387 *
x1:x2	-0.15278	0.11123	-1.374	0.1702

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.635 on 482 degrees of freedom

Multiple R-squared: 0.01871, Adjusted R-squared: 0.0126

F-statistic: 3.063 on 3 and 482 DF, p-value: 0.02784

Analysis of Variance Table

Response: milkflavour

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
FO(x1, x2)	2	19.51	9.7562	3.6510	0.02668

TWI(x1, x2)	1	5.04	5.0417	1.8867	0.17021
Residuals	482	1287.98	2.6722		
Lack of fit	5	16.06	3.2110	1.2042	0.30602
Pure error	477	1271.93	2.6665		

Stationary point of response surface:

	x1	x2
	-1.232323	-1.030303

Stationary point in original units:

percentcows	percentkiwi
5.457576	7.939394

Eigenanalysis:

\$values

[1]	0.07638889	-0.07638889
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\$vectors

	[,1]	[,2]
[1,]	-0.7071068	-0.7071068
[2,]	0.7071068	-0.7071068

```
> nozzle.rs<- rsm(milkflavour ~ FO(x1,x2), data=nozzle.CR)
> summary (nozzle.rs)
```

Call:

```
rsm(formula = milkflavour ~ FO(x1, x2), data = nozzle.CR)
```

Residuals:

Min	1Q	Median	3Q	Max
-5.0041	-1.0041	0.4619	1.3045	2.9959

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	6.34979	0.07422	85.556	<2e-16 ***
x1	-0.15741	0.09090	-1.732	0.0840 .
x2	-0.18827	0.09090	-2.071	0.0389 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.636 on 483 degrees of freedom

Multiple R-squared: 0.01487, Adjusted R-squared: 0.01079

F-statistic: 3.644 on 2 and 483 DF, p-value: 0.02686

Analysis of Variance Table

Response: milkflavour

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
FO(x1, x2)	2	19.51	9.7562	3.6444	0.02686
Residuals	483	1293.02	2.6771		
Lack of fit	6	21.10	3.5161	1.3186	0.24705
Pure error	477	1271.93	2.6665		

Direction of steepest ascent (at radius 1):

x1	x2
-0.6414206	-0.7671894

Corresponding increment in original units:

percentcows	percentkiwi
-4.810655	-1.534379

```
> nozzle.rs<- rsm(milkflavour ~ SO(x1,x2), data=nozzle.CR)
```

```
> summary (nozzle.rs)
```

```
> par(mfrow = c(1, 2))
```

```
> persp(nozzle.rs,~x1+x2, at=canonical(nozzle.rs)$xs,col = rainbow(50), contours = "colors",xlab =  
= c("percentcows (x1)","percentkiwi(x2)"),zlab = "milkflavour (milkflavour)",cex.lab=1.2)  
>contour(nozzle.rs,~x1+x2, at=canonical(nozzle.rs)$xs,xlab  
=c("percentcows(x1)","percentkiwi(x2)"),col = rainbow(15),labcex=1.5)
```

